**Experiment No. : 4**

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# Objective:

The objective of this experiment is to design a simple calculator using 8051 microcontroller and its EdSim51Di simulator to perform basic operation of addition, subtraction, division, and multiplication of two digit integer numbers. Interface the provided keypad in the simulator for entering numbers, interface switches for selecting operations (SW0 (+), SW1 (-), SW2 (×), SW3 (÷), and SW4 (=)), and interface the LCD module for displaying the result, numbers, and selected operation.

# C Code:

# #include<reg51.h>

# sbit R4=P0^0; //Rows Declared

# sbit R3=P0^1;

# sbit R2=P0^2;

# sbit R1=P0^3;

# sbit C3=P0^4; //Columns declared

# sbit C2=P0^5;

# sbit C1=P0^6;

# //Pin connection of LCD

# sbit DB7 = P1^7;

# sbit DB6 = P1^6;

# sbit DB5 = P1^5;

# sbit DB4 = P1^4;

# sbit DB3 = P1^3;

# sbit DB2 = P1^2;

# sbit DB1 = P1^1;

# sbit DB0 = P1^0;

# sbit RS = P3^0;

# sbit E = P3^1;

# //Connection of switch

# sbit sw0 = P2^0;

# sbit sw1 = P2^1;

# sbit sw2 = P2^2;

# sbit sw3 = P2^3;

# sbit sw4 = P2^4;

# sbit sw5 = P2^5;

# void delay(unsigned int no) //Delay function generating variable delay

# {

# unsigned int i,j;

# for(j=0;j<=no;j++)

# for(i=0;i<=10;i++);

# }

# void lcd\_command (char c)

# {

# P1 = c;

# RS = 0;

# E = 1;

# delay (100);

# E = 0;

# }

# //Function to initialize the LCD

# void lcd\_init()

# {

# lcd\_command (0x38); //Initialize in 8-bit mode 2 line display

# lcd\_command (0x02); //Return to home

# lcd\_command (0x01); //Clear

# lcd\_command (0x0C); //Display ON curson OFF

# lcd\_command (0x06); //Set entry mode and increment the address after every write operation

# lcd\_command (0x80); //Starting address of First row (Second row is 0x0C)

# }

# //Function to clear the LCD content

# void lcd\_clear()

# {

# lcd\_command (0x01);

# }

# char keypad()

# {

# char key\_data;

# char c='a';

# P0=0x70;

# while(c!='s')

# {

# R1=0;R2=1;R3=1;R4=1;

# if(C1==0){P0=0xF0; delay(10);c='s'; key\_data = '1'; return key\_data;}

# if(C2==0){P0=0xF0; delay(10);c='s'; key\_data = '2'; return key\_data;}

# if(C3==0){P0=0xF0; delay(10);c='s'; key\_data = '3'; return key\_data;}

# R1=1;R2=0;R3=1;R4=1;

# if(C1==0){P0=0xF0; delay(10);c='s'; key\_data = '4'; return key\_data;}

# if(C2==0){P0=0xF0; delay(10);c='s'; key\_data = '5'; return key\_data;}

# if(C3==0){P0=0xF0; delay(10);c='s'; key\_data = '6'; return key\_data;}

# R1=1;R2=1;R3=0;R4=1;

# if(C1==0){P0=0xF0; delay(10);c='s'; key\_data = '7'; return key\_data;}

# if(C2==0){P0=0xF0; delay(10);c='s'; key\_data = '8'; return key\_data;}

# if(C3==0){P0=0xF0; delay(10);c='s'; key\_data = '9'; return key\_data;}

# R1=1;R2=1;R3=1;R4=0;

# if(C1==0){P0=0xF0; delay(10);c='s'; key\_data = '\*'; return key\_data;}

# if(C2==0){P0=0xF0; delay(10);c='s'; key\_data = '0'; return key\_data;}

# if(C3==0){P0=0xF0; delay(10);c='s'; key\_data = '#'; return key\_data;}

# }

# }

# //displaying on lcd screen

# void sendChar(char c)

# {

# P1 = c;

# RS = 1;

# E = 1;

# delay(100);

# E = 0;

# }

# // -- End of LCD Module instructions

# // --------------------------------------------------------------------

# void main()

# {

# int ai,bi,sum,pos\_sum;

# char a, b, tens, ones, i = 1;

# P2 = 0xFF;

# lcd\_init();

# lcd\_clear();

# while(1)

# {

# a = keypad();

# sendChar(a);

# while(i)

# {

# if (sw0==0)

# {

# sendChar('+'); b = keypad(); sendChar(b);

# ai = a - '0';

# bi = b - '0';

# sum = ai+bi;

# i--;

# }

# if (sw1==0)

# {

# sendChar('-'); b = keypad(); sendChar(b);

# ai = a - '0';

# bi = b - '0';

# sum = ai-bi;

# i--;

# }

# if (sw2==0)

# {

# sendChar('x'); b = keypad(); sendChar(b);

# ai = a - '0';

# bi = b - '0';

# sum = ai\*bi;

# i--;

# }

# if (sw3==0)

# {

# sendChar('/'); b = keypad(); sendChar(b);

# ai = a - '0';

# bi = b - '0';

# sum = ai/bi;

# i--;

# }

# }

# i++;

# while(i)

# {

# if(sw4==0)

# {sendChar('='); i--;}

# }

# if(sum>=0) //if sum is positive

# {

# if(sum<10)

# sendChar(sum+48);

# if(sum>=10)

# {

# tens=sum/10;

# ones=sum%10;

# sendChar(tens+48);

# sendChar(ones+48);

# }

# }

# if(sum<0) //if sum is negative

# {

# if(sum>-10)

# {

# pos\_sum=(-1)\*sum; //making sum positive

# sendChar('-');

# sendChar(pos\_sum+48);

# }

# }

# i++;

# while(i) //clearing lcd display

# {

# if(sw5==0)

# {lcd\_clear(); i--;}

# }

# i++;

# }

# }

# Observations:

# ADDITION

# 

# SUBTRACTION

# 

# MULTIPLICATION

# 

# DIVISION

# 

# Results:

In this lab, we wrote the c code using 8051 microcontroller to make a simple calculator performing basic arithmetic functions such as addition, subtraction, multiplication and division. We interfaced the provided keypad in the simulator for entering numbers, interfaced switches for selecting operations, and interfaced the LCD module for displaying the result, numbers, and selected operation. The code works properly for negative numbers as well as for results of 2 digits.